

REMARKS

Applicant believes that the original claims of this application, for purposes of examination and amendment, are claims 1-27 of the Annexes to the International Preliminary Examination Report on Patentability, not claims 1-28 of the International application as originally filed. Nevertheless, in amending the claims, as set forth above, applicant has followed the Office position that the original claims are claims 1-28.

Claims 1-28 have been replaced with new claims 29-54. The new independent claim 29 combines the features of the original claims 1 and 2 whereas the new independent claim 45 combines the features of the original claims 18 and 21.

The amendments to the claims remove the rejections under 35 USC 112, first paragraph, and 35 USC 112, second paragraph.

The examiner has rejected all the original claims under 35 USC 103 relying on Stewart and Jay as the principal combination of references and relying also on at least one of Bradshaw, Fischer, Wolf, Moore, Bodson.

In view of the amendments to the claims, applicant believes that the rejections to be answered are the rejection of claim 2 over Stewart in view of Jay and further in view of Bradshaw and the rejection of claim 21 over Stewart in view of Jay and further in view of Fischer, Wolf, Moore, Bodson and Bradshaw.

Stewart relates to a method for removing chloride and copper from a copper sulfate solution that is formed of zinc flue dust. The flue dust is leached in sulfuric acid solution to dissolve zinc oxide of the flue dust. The flue dust contains also lead oxide that does not dissolve but remains in the sludge that is filtered (Unit A). Chloride is first removed from the solution by using metallic copper powder that reacts with cupric ions in the solution and forms cuprous ions. Cuprous ions react with chloride and the created cuprous chloride is precipitated. The pH of the solution is adjusted to be not greater than 3 just before the chloride removal (Unit B). In Unit C, copper is removed from the solution by cementation, which is conventionally done with zinc

powder. Iron that is contained in the flue dust is removed from the solution in Unit D and Unit E is crystallization of zinc sulfate.

Jay describes a method for recovering metals, for example copper, from acid mine drainage and in other applications, where the recovery of the copper metal ion from a dilute aqueous solution is desired (page 4, lines 20-25). Another usage is for example for the displacement of copper and other metals from their cyanide complex (page 6, lines 20-21). Recovering of the metal takes place by contacting a polymeric based material with the slurry or solution containing the metal to be removed. The polymeric material contains a solid superhydrophilic polyurethane polymer, which rapidly absorb significant quantities of water (page 3, lines 6-15). In the next step the polymeric material is separated from the slurry and after that the selected metal is recovered from the polymeric material.

In accordance with the claimed subject matter of this application, the ion exchanger that is used is a silica-based chelating ion exchanger and not a polymeric based ion exchanger. Differences between them are described in the present specification, for example in the paragraph starting on the bottom of page 5. The next paragraph (page 6, line 7 onwards) states that the method of this application is developed to remove copper from concentrated zinc sulphate solutions. There are at least two clear differences between Jay and the present claimed subject matter: first, Jay does not use a silica-based ion exchanger; and second, Jay does not describe selective separation of copper from concentrated zinc sulphate solution but separating copper from dilute solutions. It is true that the functional group of the ion exchanger used in the present invention is polymeric amine but the body of the ion exchanger is silica, which does not swell or shrink in salt solutions. Jay does not disclose or suggest an alkyl-silylated silica-based ion exchanger.

The examiner asserts that Chapman discloses that ion exchange and cementation with zinc are equivalent processes for removing copper from a zinc sulfate solution. In making this assertion, the examiner relies on the wording of claim 1 of Chapman which refers to one stage of a two-stage procedure as being treatment of a solution to precipitate copper using at least one procedure drawn from the group consisting of cementation with zinc dust, ion exchange, and others. Applicant notes that Chapman is an Australian patent document and submits that the record does not show that, under Australian practice, the different elements of a group set forth in the manner of claim 1 of Chapman are recognized in the art as being equivalent. Applicant believes that the only examples given in Chapman employ cementation with zinc dust and therefore there is no basis in Chapman for asserting that cementation with zinc dust and ion exchange are equivalent. In any event, the examiner has not referred to Chapman in the statement of the rejection and applicant therefore submits that the examiner may not properly rely on the disclosure in Chapman.

The examiner has asserted that Bradshaw teaches a process of separating a selected ion from a plurality of other ions in a multiple ion solution by using an ion exchanger which consists of a polymeric amine attached to an alkyl-silylated silica base. Bradshaw discloses removal of, for example, Sr^{2+} from 1-molar MgCl_2 -solution (col. 5, lines 1-3) and silver, lead and cadmium from one another in culinary water (col. 8, lines 10-20). In addition there is mentioned metals Ti, Ba, Pb and Ni (Table 1, col. 8-9) and that selectivity of the silica gel separation material in respect of Pb and Ba ions over Na, Mg and Ca ions is much greater (col. 9, lines 17-22). However, there is no mention of what the selectivity is when the metal to be separated is copper and the solution is concentrated zinc sulfate solution. As can be seen in Bradshaw, ion exchangers are metal selective and being selective for, for example, strontium does not tell us anything of copper selectivity.

Applicant could find no reference in Bradshaw to the material being a chelating alkyl-silylated material of which the functional group is a polymeric amine. If the examiner adheres to the view that Bradshaw discloses or suggests such a material, applicant requests that the examiner should point out the support for this position.

Applicant respectfully disagrees with the examiner's position regarding patentability of the subject matter of the original claim 2, now contained in claim 29, because the copper removal of Jay differs clearly from the method presented in applicant's claim 29. The combination of the disclosures of the references would not have been obvious because Stewart is concerned with a concentrated zinc sulfate solution as the examiner stated on page 6 of the Office Action and Jay is concerned only with dilute solutions.

In view of the foregoing, applicant submits that the subject matter of claim 29 is not disclosed or suggested by Jay, Stewart and Bradshaw, whether taken singly or in combination. Therefore, claim 29 is patentable and it follows that the dependent claims also are patentable.

Claim 45 is narrower in scope than claim 29. Therefore, claim 45 is patentable for the reasons presented above in support of claim 29. It follows that the dependent claims 46-54 also are patentable.

Applicant offers the following comments on other references that the examiner has applied to the claims.

Fisher describes results of tests to determine the effectiveness of some silica-polyamine composite materials for extracting and separating metals ions from mining wastewater. The contents of the metals are low, some hundred parts per million (ppm) and the solution is mining wastewater. The results are good especially with copper. However, the test conditions differ clearly from the present claimed subject matter since instead of mining wastewater the solution with which the present claimed subject matter is concerned is concentrated zinc sulfate solution

and the content of copper at least thousand-fold (131.9 ppm/624 mg; page 3131 in Fischer/claim 5).

Wolf relates to using of a Wofatit ion exchanger for removal of small amount of an undesired metal from an aqueous salt of another metal. An example provided by Wolf is removing iron and chromium from zinc sulfate solution but there is no mention about the range of the undesired metals. The pretreatment steps of the ion exchanger are washing first with hydrochloric acid (HCl) and after that with distilled water then directing 4 M zinc sulfate solution through the column so that at least a part of H^+ ions of the hydrochloric acid are substituted with Zn^{2+} ions. After these pretreatment steps the zinc sulfate solution to be purified is fed to the column.

The ion exchanger disclosed by Wolf works differently from the exchanger used in the present claimed subject matter since the pretreatment step is washing with acid. As stated in the specification of the present application: "It was found that the copper capacity of the ion exchanger in free alkaline form is considerably greater than that of an acid-treated ion exchanger." Page 7, lines 5-7. Wolf uses an ion exchanger to separate iron and chromium from the zinc sulfate. Wolf does not teach that when the impurity metal is copper then the exchanger should be alkaline treated. The zinc sulfate content of the solution is 4 N (normality), which in practice means that there is about 290 g/l $ZnSO_4$ in the solution. The examiner asserts that the zinc sulfate solution used in the pretreatment is uncontaminated but applicant could not find any disclosure in Wolf that supports the examiner's contention that the zinc sulfate solution used in the pretreatment is uncontaminated. However the concentration of the pretreatment solution and the solution to be purified is same.

The examiner refers to Wolf and says: "Iron is a transition metal similar to copper and would behave in a similar manner to copper with regards to ion exchangers". However, Fischer states at page 3130, last paragraph, lines 2-3 that "...iron can

interfere with selectivity and reduce the purity of extracts containing the more valuable metals."

Bodson does not teach that a part of the raw solution (zinc sulphate solution) is fed to a separate cuprous oxide precipitation stage where copper in the solution reacts with zinc powder to form cuprous oxide that is routed to the chloride removal stage. Bodson has no bleed for cuprous oxide preparation from the raw solution.

Respectfully submitted,

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